

WHAT IS CLAIMED IS:

1. A developing device, comprising:

a developing agent carrying member which faces a latent image carrying member and rotates in a direction such that the portion thereof facing said latent image carrying member rotates in the same direction as said latent image carrying member at that position, while carrying on the surface thereof a developing agent containing magnetic particles;

a casing which forms a developing agent storing space therein for storing developing agent, and has an opening whereby a portion of the surface of said developing agent carrying member in the direction of rotation of said developing agent carrying member is made to face said latent image carrying member;

a developing agent restricting member disposed within said casing, upstream, in the direction of rotation of said developing agent carrying member, of a developing region where said developing agent carrying member and said latent image carrying member face one another, such that a gap is formed between said developing agent restricting member and said developing agent carrying member, so as to restrict the amount of developing agent supplied to said developing region; whereby developing is performed by bringing the developing agent on the surface of said developing agent carrying member with said latent image carrying member at

said developing region;

magnetic field generating means for generating a magnetic field such that said developing agent is made to form a magnetic brush so as to close off the space between the surface of said developing agent carrying member and the inner wall of said casing at least one time while said developing agent being carried by the surface of said developing agent carrying member is being carried from said gap to said developing region; and

a gas exhaust path for exhausting gas, in an upstream space defined by the surface of said developing agent carrying member and the inner wall of said casing upstream in the rotational direction of said developing agent carrying member from said developing region, into the inner space of a device or member employing a structure whereby developing agent existing therein is prevented from scattering within an image formation apparatus, at a position downstream in the rotational direction of said developing agent carrying member from a brush formation position where said developing agent forms a magnetic brush due to said magnetic field generating means.

2. The developing device according to Claim 1, wherein an opening of said gas exhaust path is formed in said upstream space so that gas within said upstream space is

exhausted from the end portion of said upstream space in the direction of the rotational axis of said developing agent carrying member.

3. The developing device according to Claim 2, wherein two of said gas exhaust paths are provided, and wherein openings of said gas exhaust paths are each formed in said upstream space so that gas within said upstream space is exhausted, via said gas exhaust paths, from both end portions of said upstream space in the direction of the rotational axis of said developing agent carrying member.

4. The developing device according to any one of Claims 1 through 3, wherein a negative pressure space, adjacent to said developing agent restricting member in the downstream direction of rotation of said developing agent carrying member, is used as said inner space.

5. A developing device comprising:  
a latent image carrying member; and  
a developing device for developing latent images on said latent image carrying member;  
wherein a developing device according to any one of Claims 1 through 4 is used as said developing device.

6. A developing device comprising:

a latent image carrying member;

a developing device for developing latent images on said latent image carrying member; and

a cleaning device which recovers developing agent adhering to a member to be cleaned;

wherein a developing device according to any one of claims 1 through 3 is used as said developing device;

and wherein inner space of said cleaning device for storing developing agent collected by said cleaning device is used as said inner space.

7. A developing device, comprising:

a developing agent carrying member which faces a latent image carrying member and rotates in a direction such that the portion thereof facing said latent image carrying member rotates in the same direction as said latent image carrying member at that position, while carrying on the surface thereof a developing agent; and

a casing which forms an inner space therein for storing developing agent, and has an opening whereby a portion of the surface of said developing agent carrying member in the direction of rotation of said developing agent carrying member is made to face said latent image carrying member;

wherein said developing device is configured such that

external air is capable of flowing in toward the inner space of said casing, through an inlet gap formed between the edge portion of said opening positioned at the downstream side in the direction of rotation of said developing agent carrying member and the surface of said latent image carrying member;

and further comprising

a second opening, formed at an inner wall portion of said casing, further upstream in the direction of rotation of said developing agent carrying member from the position where developing agent closes off part or all of the channel space between the surface of said developing agent carrying member and the inner wall of said casing, which can serve as a channel for external air flowing into the inner space of said casing through said inlet gap; and

a gas exhaust path connected to said second opening for exhausting gas within said channel space to a developing agent scattering-prevention space through said second opening.

8. The developing device according to Claim 7, further comprising suction means for suctioning gas from the end portion of said gas exhaust path of said developing agent scattering-prevention space.

9. The developing device according to Claim 8, further

comprising a developing agent restricting member for restricting the amount of developing agent carried on the surface of said developing agent carrying member in order to adjust the amount of developing agent transported to said developing region, said developing agent restricting member being positioned facing the surface of said developing agent carrying member with a predetermined gap therebetween at a position further upstream from said developing region in the direction of rotation of said developing agent carrying member, wherein a negative pressure space, adjacent to said developing agent restricting member in the downstream direction of rotation of said developing agent carrying member, is used as said suction means.

10. The developing device according to either of Claims 8 or 9, wherein the inner space of said casing is configured so as to be in a generally airtight space, with said inner space being used as said developing agent scattering-prevention space, and with gas within said inner space being suctioned by said suction means.

11. The developing device according to Claim 10, further comprising a preventing member disposed in the upstream direction of flow of said developing agent of said opening, for preventing passage of developing agent flowing

in said inner space through said opening, around the opening of said gas exhaust path opened into said inner space.

12. A developing device, comprising:

a developing agent carrying member which faces a latent image carrying member and rotates in a direction such that the portion thereof facing said latent image carrying member rotates in the same direction as said latent image carrying member at that position, while carrying on the surface thereof a developing agent; and

a casing which forms an inner space therein for storing developing agent, and has an opening whereby a portion of the surface of said developing agent carrying member in the direction of rotation of said developing agent carrying member is made to face said latent image carrying member;

wherein said developing device is configured such that external air is capable of flowing in toward the inner space of said casing, through an inlet gap formed between the edge portion of said opening positioned at the downstream side in the direction of rotation of said developing agent carrying member and the surface of said latent image carrying member;

and further comprising

a second opening, formed at an inner wall portion of said casing, further upstream in the direction of rotation of said developing agent carrying member from the position

where developing agent closes off part or all of the channel space between the surface of said developing agent carrying member and the inner wall of said casing, which can serve as a channel for external air flowing into the inner space of said casing through said inlet gap;

and a gas exhaust path connected to said second opening for exhausting gas within said channel space outside of said developing device through said second opening; and

a filter member disposed in said gas exhaust path.

13. A developing device, comprising:

a developing agent carrying member which faces a latent image carrying member and rotates in a direction such that the portion thereof facing said latent image carrying member rotates in the same direction as said latent image carrying member at that position, while carrying on the surface thereof a developing agent;

a casing which forms an inner space therein for storing developing agent, and has an opening whereby a portion of the surface of said developing agent carrying member in the direction of rotation of said developing agent carrying member is made to face said latent image carrying member; and

a transporting member for transporting developing agent in the inner space of said casing, in the direction of



rotation of said developing agent carrying member;

wherein said developing device is configured such that external air is capable of flowing in toward the inner space of said casing, through an inlet gap formed between the edge portion of said opening positioned at the downstream side in the direction of rotation of said developing agent carrying member and the surface of said latent image carrying member, due to an airflow passing through the channel space between said developing agent carrying member and said transporting member;

and further comprising

a shielding member for shielding developing agent transported by said transporting member, from the airflow passing through said channel gap.

14. A developing device according to Claim 13, further comprising a developing agent restricting member for restricting the amount of developing agent carried on the surface of said developing agent carrying member in order to adjust the amount of developing agent transported to said developing region, said developing agent restricting member being positioned facing the surface of said developing agent carrying member with a predetermined gap therebetween at a position further upstream from said developing region in the direction of rotation of said developing agent carrying

member, wherein a negative pressure space, adjacent to said developing agent restricting member in the downstream direction of rotation of said developing agent carrying member, and the inner space of said casing, are made to communicate, so as to generate an airflow passing through said channel gap.

15. The developing device according to either of Claims 13 or 14, further comprising:

two transporting screws as said transporting member, which transport the developing agent in mutually opposite direction along the rotation axis direction of said developing agent carrying member, by fins fixed on the rotating axes of said transporting screws extending in the rotation axis direction of said developing agent carrying member; and

moving paths provided at both ends regions in the rotation axis direction of said two transporting screws, whereby developing agent which has reached the transportation ending portion of one transporting screw is moved to the transportation starting portion of the other transporting screw;

wherein said shielding member is disposed so as to shield at least the transporting screw at the side closer to said developing agent carrying member from said airflow.

16. The developing device according to Claim 15, wherein, the developing agent moving through, of said moving paths, at least the moving path which moves the developing agent to the transportation starting portion of the transporting screw at the side closer to said developing agent carrying member, is shielded from said airflow by said shielding member.

17. The developing device according to either of Claims 15 or 16, further comprising, on the face of said shielding member which faces said transporting screw, a flexible member which comes into contact with the perimeter of the fin of said transporting screw.

18. The developing device according to any of the Claims 15 through 17, further comprising a suction opening for suction means for suctioning gas, said suction opening provided on the inner wall portion of the casing near to the channel space Between the transporting screw closer to said developing agent carrying member and said developing agent carrying member.

19. The developing device according to any of the Claims 15 through 17, further comprising airflow generating

means for generating an airflow which passes through the channel space Between the transporting screw closer to said developing agent carrying member and said developing agent carrying member, and passes through the perimeter region of the transporting screw not closer to said developing agent carrying member.

20. The developing device according to any of the Claims 7 through 19, further comprising gas supplying means for supplying gas to said inlet gap, for enhancing conditions within the inner space of said casing so as to be suitable for toner charging properties.

21. An image formation apparatus comprising:  
a latent image carrying member; and  
a developing device for developing latent images on said latent image carrying member;  
wherein the developing device according to any of the Claims 7 through 20 is used as said developing device.

22. A process cartridge configured so as to be detachable mounted to the main unit of the image formation apparatus according to Claim 21, wherein at least said latent image carrying member and said developing agent carrying member are configured integrally.

23. A developing device comprising:

a developing sleeve capable of forming a magnetic brush, disposed facing a latent image carrying member and disposed within housing which is almost airtight except for the portion where said developing sleeve faces said latent image carrying member, in order to effect processing for visualizing electrostatic latent images formed on said latent image carrying member; and

a screw member which transports developing agent toward said developing sleeve while stirring said developing agent;

wherein a communicating portion is provided which has a starting end portion and an ending end portion at a positive pressure portion and a negative pressure portion emerging at the upstream and downstream of the magnetic brush carried by said developing sleeve in the direction of movement thereof, thereby causing airflow between said positive pressure portion and negative pressure portion.

24. The developing device according to Claim 23, wherein a starting end opening is formed in the developing agent transporting path at a developing agent drawing-up starting side where the developing agent is drawn up by said screw member toward said developing sleeve, and wherein an ending end opening has an exhaust channel, provided behind a

layer thickness restricting member for restricting the thickness of said developing agent in front of a position where said developing sleeve faces said latent image carrying member, as a flowing portion for air.

25. The developing device according to Claim 24, wherein said starting end opening has a shape which widens from the upper portion thereof toward the lower portion thereof in the direction in which developing agent drawn up toward the developing sleeve falls, and has an opening formed at the widened portion.

26. The developing device according to either of Claims 24 or 25, wherein a plurality of said starting openings are provided in the axial direction of said developing sleeve, with each of said starting end openings being connected with said ending end opening such that pressure distribution in the axial direction of said developing sleeve is uniform.

27. The developing device according to Claim 26, wherein said starting end openings positioned at the outer sides in the axial direction of said developing sleeve are connected to an ending end opening positioned at the center side of in the axial direction of said developing sleeve.

28. A developing device comprising:

a developing sleeve capable of forming a magnetic brush, disposed facing a latent image carrying member and disposed within housing which is almost airtight except for the portion where said developing sleeve faces said latent image carrying member, in order to effect processing for visualizing electrostatic latent images formed on said latent image carrying member; and

a screw member which transports developing agent toward said developing sleeve while stirring said developing agent;

wherein a communicating portion is provided which has a starting end portion and an ending end portion at a positive pressure portion and a negative pressure portion emerging at the upstream and downstream of the magnetic brush carried by said developing sleeve in the direction of movement thereof, with said start end portion being provided near a repelling magnetic field formation region for causing developing agent to fall which is provided on said developing sleeve, and with said ending end portion communicating with said starting end portion being provided behind a layer thickness restricting portion for restricting the thickness of said developing agent in front of a position where said developing sleeve facing said latent image carrying member, thereby causing airflow between said positive pressure

portion and negative pressure portion.

29. The developing device according to Claim 28, wherein a channel whereby said starting end portion and said ending end portion communicate, has the starting end portion thereof connected to the end side in the axial direction of said developing sleeve, and the ending end portion thereof connected to center side in the axial direction of said developing sleeve.

30. The developing device according to either of Claim 23 or Claim 28, further comprising a channel for communication between

near a repelling magnetic field formation region for causing developing agent to fall which is provided on said developing sleeve, and

the ambient atmosphere,

wherein said channel is configured so as to be capable of opening and closing.

31. The developing device according to any one of Claims 23 through 30, wherein the gap as to said latent image carrying member at a position past said developing position in the direction of movement of said developing sleeve in said housing is smaller than the gap at said



developing position.

32. The developing device according to either of Claim 23 or Claim 28, further comprising a circulation chamber for permitting circulation of air at a position past said developing position in the direction of movement of said developing sleeve in said housing.

33. The developing device according to Claim 32, wherein said circulation chamber communicates with a channel for communication between

near a repelling magnetic field formation region for causing developing agent to fall which is provided on said developing sleeve, and

the ambient atmosphere,

wherein said channel is configured so as to be capable of opening and closing.

34. A process cartridge using the developing device according to any one of Claims 23 through 33.

35. The process cartridge according to Claim 34, wherein the channel for communication between near a repelling magnetic field formation region for causing developing agent to fall which is provided on said

developing device, and the ambient atmosphere, is closed at the time of mounting or detaching said process cartridge.

36. The process cartridge according to Claim 35, wherein the channel for communication between near a repelling magnetic field formation region for causing developing agent to fall which is provided on said developing device, and the ambient atmosphere, is closed at the time of standby for developing processing.

37. An image formation apparatus using the developing device according to any one of the Claims 23 through 33 or the progress cartridge according to any one of the Claims 34 through 36.

38. A developing device comprising a developing sleeve capable of forming a magnetic brush, disposed facing a latent image carrying member and disposed within housing which is almost airtight except for the portion where said developing sleeve faces said latent image carrying member, in order to effect processing for visualizing electrostatic latent images formed on said latent image carrying member; wherein an opening, formed in a wall face of said housing facing said developing sleeve, faces the leading edge of the developing agent carried by said developing

sleeve following the processing for visualizing the electrostatic latent images.

39. The developing device according to Claim 38, wherein said opening is provided between an entrance of said housing where the developing agent carried by said developing sleeve begins to enter said housing following finishing the processing for visualizing the electrostatic latent images, and a position where a transporting magnetic pole provided to said developing sleeve is disposed.

40. The developing device according to either of Claims 38 or 39, wherein said opening is positioned upstream in the direction of movement of said developing sleeve for a magnetic pole positioned downstream from a developing primary magnetic pole facing said latent image carrying member.

41. The developing device according to any one of Claims 38 through 40, wherein suctioning force acts upon said opening.

42. The developing device according to any one of Claims 38 through 41, wherein said opening communications

with the inside of said developing device, or with the outside.

43. The developing device according to Claim 42, wherein said opening is positioned at one end of a detour path communicating with a position at which the developing agent carried by said developing sleeve is scraped off of said developing sleeve and flows within said developing device.

44. The developing device according to any one of Claims 38 through 43, wherein said opening has a length in the longitudinal direction set longer than the length of said developing sleeve in the axial direction.

45. The developing device according to any one of Claims 38 through 44, wherein said opening is provided so as to be capable of taking in the developing agent carried by said developing sleeve in a direction opposite to the direction of motion of said developing sleeve.

46. The developing device according to Claim 43, wherein said detour path has a greater area at a channel portion communicating with the inside of said developing device, than the area of said opening.

47. The developing device according to either of Claims 43 or 46, further comprising a magnetic shield member in a channel portion of said detour path communicating with the inside of said developing device.

48. The developing device according to any one of Claims 38 through 44 or 46, wherein the expression

$$G2 \leq G3$$

holds, wherein

G2 represents the gap between said developing sleeve and the wall face of said housing at a position prior to the developing agent passing said opening facing said developing sleeve, and

G3 represents the gap between said developing sleeve and the wall face of said housing at a position following the developing agent passing said opening facing said developing sleeve.

49. The developing device according to any one of Claims 38 through 44 or 46, wherein the expression

$$G1 \geq G2 - t$$

holds, wherein

G1 represents the gap between the entrance of said housing where the developing agent enters and said latent

image carrying member,

G2 represents the gap between said developing sleeve and the wall face of said housing at a position prior to the developing agent passing said opening facing said developing sleeve, and

t represents the thickness of the layer of developing agent carried by said developing sleeve which has passed the developing region.

50. The developing device according to any one of Claims 38 through 45, wherein the expression

$$G2 < G3$$

holds, wherein

G2 represents the gap between said developing sleeve and the wall face of said housing at a position prior to the developing agent passing said opening facing said developing sleeve, and

G3 represents the gap between said developing sleeve and the wall face of said housing at a position following the developing agent passing said opening facing said developing sleeve.

51. The developing device according to any one of Claims 38 through 45, wherein the expression

$$G1 > G2 - t$$

holds, wherein

G1 represents the gap between the entrance of said housing where the developing agent enters and said latent image carrying member,

G2 represents the gap between said developing sleeve and the wall face of said housing at a position prior to the developing agent passing said opening facing said developing sleeve, and

t represents the thickness of the layer of developing agent carried by said developing sleeve which has passed the developing region. .

52. The image formation apparatus using the developing device according to any one of Claims 38 through 50.